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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Application No.:

09/841,305

Filing Date:

April 24, 2001

Inventors:

Wellington et al.

Title:

IN SITU THERMAL

PROCESSING OF A HYDROCARBON

CONTAINING FORMATION

WITH A SELECTED MOISTURE CONTENT

Examiner:

J. J. Kreck

Group/Art Unit:

3673

Atty. Dkt. No.:

5659-02200/EBM

CERTIFICATE OF MAILING UNDER 37/C.F.R. §1.8

DATE OF DEPOSIT:

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Commissioner for Patents

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AMENDMENT; RESPONSE SUBMITTED WITH REQUEST FOR CONTINUED EXAMINATION

ATTN: BOX RCE

Commissioner for Patents Washington, D.C. 20231

Sir:

Please amend the above-captioned application as follows:

Inventors: Wellington et al. Appl. Ser. No.: 09/841,305 Atty. Dkt. No.: 5659-02200

In the Claims:

Below is a clean copy of amended claims. A marked-up copy of the amended claims is provided in an accompanying document.

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2040. (amended) The method of claim 2039, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.



2047. (amended) The method of claim 2039, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day in a pyrolysis temperature range from about 270 °C to about 400 °C.

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2048. (amended) The method of claim 2039 wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (f'wr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

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2050. (amended) The method of claim 2039, wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).



2062. (amended) The method of claim 2039, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the

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molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2072. (amended) The method of claim 2039, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 250 millidarcy.

2073. (amended) The method of claim 2029, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

2086. (amended) The method of claim 2078, further comprising controlling the heat such that an average heating rate of the part of the formation is/less than about 1 °C per day in a pyrolysis temperature range of about 270 °C to about 400 °C

2087. (amended) The method of claim 2078, wherein providing heat from the one or more heaters to at least the portion of the formation/comprises:

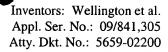
heating a selected volume (V) of the hydrocarbon containing formation from the one or more heaters, wherein the formation has an average heat capacity (C_{ν}) , and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

2089. (amended) The method of claim 20/1/8, wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).



2101. (amended) The method of claim 2078, wherein the produced mixture comprises a noncondensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-



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condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure



2111. (amended) The method of claim 2078, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 250 millidarcy.

2112. (amended) The method of claim 2078, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.



5398. (amended) A method of treating a hydrocarbon containing formation in situ, comprising: evaluating a moisture content of hydrocarbon containing material in the hydrocarbon containing formation to identify a portion of the hydrocarbon containing material with a moisture content that is less than about 20%;

providing heat from one or more heaters positioned in heater wells to the portion to heat the portion so that an average temperature in the portion is above a temperature sufficient to pyrolyze hydrocarbon containing material in the portion; and

producing a mixture from the formation.



5403. (amended) The method of claim 5398, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.